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Research Article

Reclassification of four South American species of *Laemophloeus* Dejean, 1835 into *Charaphloeus* Casey, 1916 (Coleoptera, Laemophloeidae)

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Abstract

The generic placement of four South American species currently assigned to the lined flat bark beetle genus *Laemophloeus* Dejean (*sensu lato*) (Cucujoidea, Laemophloeidae) is re-assessed based on the examination of type material. As a result, the following species are hereby transferred to the genus *Charaphloeus* Casey: *Charaphloeus aeneus* (Grouvelle, 1876), **comb. nov.**; *C. deletus* (Grouvelle, 1896), **comb. nov.**; *C. gounellei* (Grouvelle, 1896), **comb. nov.**; and *C. pilatei* (Grouvelle, 1876), **comb. nov.** Taxonomic and nomenclatural notes are provided and lectotypes are designated for all four species. Distributional data are also synthesised. Based on the type and additional material, *C. pilatei* is re-described and illustrated in detail including diagnostic characters of the mouthparts and genitalic structures and its known distribution is expanded.

Key Words

Flat beetles, Neotropical, new combinations, nomenclature, systematic, taxonomy

Introduction

Laemophloeidae Ganglbauer, 1899, is a small and poorly known family of Cucujoidea, with about 500 species in more than 40 genera (McElrath et al. 2025), whose classification has also undergone changes in recent history (Thomas 1984, 1993; Lawrence and Newton 1995; McElrath et al. 2015). In the past, this and other cucujoid groups were considered as subfamilies of Cucujidae Latreille, 1802 because of their great similarity in body shape, which is strongly dorsoventrally flattened in most members. However, it is now widely accepted that this similarity in general body shape was achieved by evolutionary convergence due to a strong adaptation to living in subcortical environments (Thomas 1993; McElrath et al. 2015). Laemophloeidae comprises a relatively homogeneous and distinctive assemblage of species that present, in addition to a strongly dorsoventrally flattened body, sublateral lines on the pronotum and head represented by grooves or carinae, elytral cells and an elongated antenna (Thomas 2002), traits that give rise to their English common name "lined flat bark beetles". Laemophloeidae is divided into two subfamilies: Laemophloeinae Ganglbauer, 1899, including the vast majority of species and genera; and Propalticinae Crowson, 1952, a small group, previously treated as a family and recently subsumed to Laemophloeidae, which includes only 40 species in two genera (Gimmel 2011; McElrath et al. 2015).

The lined flat bark beetle genus *Laemophloeus* Dejean, 1835 was re-defined by Lefkovitch (1959) and Thomas (2013) and currently comprises 32 species including two newly-described taxa (Bento and Rafael 2025), with 26 occurring exclusively in the New World and only six distributed in Europe, North Africa and Asia (Lefkovitch

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1959; Thomas 2015), while the number of undescribed species remains high and is expected to increase with further study. The genus sensu stricto is easily diagnosed by several morphological traits, amongst which are a pronotum with an antebasal denticle, humeral carinae of elytra present, coxae widely separated, intercoxal process of abdominal sternite III acuminate, tarsal formula 5-5-4 in males and 5-5-5 in females and internal sac with flagellum and basal plates (Lefkovitch 1959; Thomas 2015). However, as a consequence of having historically served as a "waste-basket" taxon, *Laemophloeus* sensu lato still represents a highly heterogeneous assemblage, currently comprising more than a hundred species globally distributed, most of which remain poorly defined or misclassified in the genus and in need of revisionary work (Thomas 2016), despite the recent efforts to bring order to the group following the broad acceptance of its generic redefinition (Bremer 2023, 2024; Bento and Rafael 2024).

In this context, the identity of four South American species currently assigned to *Laemophloeus* (sensu lato) was clarified based on the analysis of the type and additional specimens, which allowed us to ascertain their generic placement. Several characters such as the deeply grooved, complete frontoclypeal suture, the elytral surface convex and with only the third cell present, the antebasal denticle of pronotum absent, the prosternal process broad and the procoxal cavities posteriorly open, place these species in the genus *Charaphloeus* Casey, 1916 as currently defined (Bremer 2023, 2024), increasing the genus diversity to 35 species. These findings provided the basis for establishing the four new combinations proposed in this paper: *C. aeneus* (Grouvelle, 1876), comb. nov.; *C. deletus* (Grouvelle, 1896), comb. nov.; *C. gounellei* (Grouvelle, 1896), comb. nov.; and *C. pilatei* (Grouvelle, 1876), comb. nov. The lectotype of each species is designated with the purpose of clarifying the application of the name, while *C. pilatei* comb. nov. is diagnosed, re-described in detail and newly recorded in the Brazilian states of Paraná and Santa Catarina.

Materials and methods

Type and additional specimens treated in this paper are deposited in the Muséum national d'Histoire naturelle, Paris, France (**MNHN**; Antoine Mantilleri) and the Coleção Entomológica Padre Jesus Santiago Moure, Universidade Federal do Paraná, Curitiba, Brazil (**DZUP**; Lúcia Massutti Almeida).

Morphological terms follow Beutel and Lawrence (2016) for the general morphology, with the adoption of terms proposed and/or discussed by Thomas (2013, 2016) and Bremer (2023, 2024). Total body **length** was measured from the anterior margin of clypeus at middle to the apex of elytra and body **width** was measured at mid-elytra. In the present paper, surfaces were considered smooth if there is no punctation, moderately punctated if punctures were two to six puncture diameters apart and densely punctated if punctures were less than two diameters apart.

Photographs of non-type specimens of *C. pilatei* were taken using a Leica M165C stereomicroscope in combination with a Leica DFC420 camera and a Leica DFC290HD camera attached to a Leica DM5500B compound microscope. The final images were processed using the Leica Application Suite (LAS) version 4.1 and the Helicon Focus (HeliconSoft) software. All the images of type specimens were taken by Christophe Rivier (MNHN) and provided by Antoine Mantilleri (MNHN).

The verbatim label data from type specimens are transcribed in quotation marks, with "/" separating lines on the same label and "//" separating different labels. Label data from non-type specimens are provided as follows: "country, state or province, locality, date, collector or old collection (quantity of specimens, sex symbol, collection acronym)".

Results

Charaphloeus aeneus (Grouvelle, 1876), comb. nov.

Fig. 1A–C

Laemophloeus aeneus Grouvelle, 1876: 492, plate 8: fig. 9 (original combination) (nec *Laemophloeus aeneus* Sharp, 1885 [preoccupied name, now *Parandrita aenea*); Kessel, 1923: 93 (checklist); 1926: 72, 86 (key, checklist); Hetschko, 1930: 21 (catalogue); Blackwelder, 1945: 419 (checklist).

Type material. ***Lectotype*** (here designated) • deposited at MNHN, labelled: "n. Fribou [Nova Friburgo]/ Deyr" (brown, handwritten) // "Type" (light brown, printed) // "Aeneus / A. Grouv. Ann Fr. / p." (light brown, printed) // "Muséum Paris / 1917 / coll. A. Grouvelle" (white, printed) // "SYNTYPE" (red, printed) // "SYNTYPE / Laemophloeus / aeneus Grouvelle, 1876" (white, printed) // "MNHN, Paris / EC51936" (white, printed with QR code).

Distribution. BRAZIL. Rio de Janeiro: Nova Friburgo (Grouvelle 1876).

Remarks. Based on the analysis of the types of both species, *Charaphloeus aeneus* comb. nov. closely resembles *C. frequens* (Sharp, 1899) because of the general body form and colour light to dark brown, but it is distinctive by the frontoclypeal suture nearly straight (V-shaped in *C. frequens*) and the anterior margin of clypeus with shallow antennal emarginations (deep, incised antennal emarginations in *C. frequens*) (syntypes of *C. frequens* imaged in Bremer (2023; figs 1–4)).

Even though there is no size variation in the original description of this species, we accept the only available original specimen as a syntype due to the absence of explicit evidence that Grouvelle (1876) based his description on a single specimen. This specimen is here designated as the lectotype (Fig. 1A) of *C. aeneus* in order to ensure nomenclatural stability. Hetschko (1930) recorded this species from Rio Grande do Sul, but this likely represents a misinterpretation of its type locality in Rio de Janeiro state.

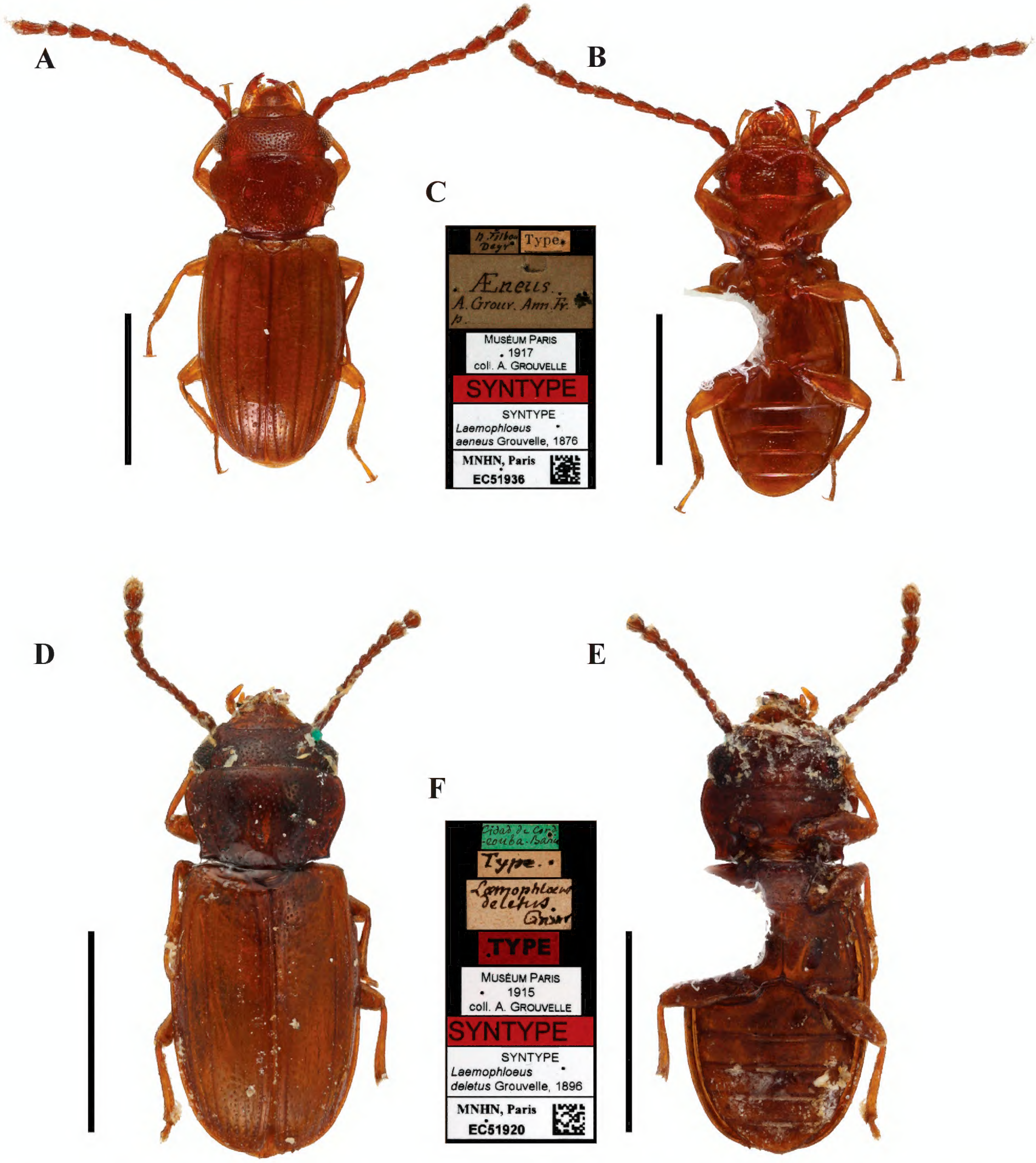

Figure 1. *Charaphloeus aeneus* (Grouvelle, 1876), comb. nov.: **A.** Dorsal view; **B.** Ventral view; **C.** Labels of the lectotype (here designated). *Charaphloeus deletus* (Grouvelle, 1896), comb. nov.: **D.** Dorsal view; **E.** Ventral view; **F.** Labels of the lectotype (here designated). Scale bars: 1 mm (**A, B, D, E**). Photographs by Christophe Rivier (MNHN).

Nomenclatural note. Although *Laemophloeus aeneus* Sharp, 1885 is a junior primary homonym of *Laemophloeus aeneus* Grouvelle, 1876, the former was subsequently transferred to *Parandrita* LeConte & Horn, 1880 by Sharp (1908) and has remained in use without replacement. According to Article 23.9.5 of the International Commission on Zoological Nomenclature (1999): "*When an author discovers that a species-group name in use is a junior primary homonym of another species-group name also in use, but the names apply to taxa not considered congeneric after 1899, the author must not automatically replace the junior homonym; the case should be referred to the Commission for a ruling under the plenary power and meanwhile prevailing usage of both names is to be maintained*". Regarding its applicability to this case, Article 23.9.5 is not satisfied because both nominal species remained congeneric until 1908 (i.e. after 1899), when the junior homonym was transferred to *Parandrita*.

Hence, a new replacement name (*nomen novum*) for *Parandrita aenea* is required under the provisions of the ICZN Articles 57.2 and 60 to solve the primary homonymy and best serve nomenclatural stability. However, we follow current usage of the name until a future revision of *Parandrita*, which is the best place to address the issue (ICZN 1999).

Charaphloeus deletus (Grouvelle, 1896), comb. nov.

Fig. 1D–F

Laemophloeus deletus Grouvelle, 1896: 191 (original combination); Kessel 1923: 93 (checklist); 1926: 70, 80, 88 (key, note, checklist); Hetschko 1930: 27 (catalogue); Blackwelder 1945: 419 (checklist).

Type material. ***Lectotype*** (here designated) • deposited at MNHN, labelled: "cidad de Cond / -eouba [Condeúba]. Bahia" (green, handwritten) // "Type" (light brown, handwritten) // "Laemophloeus / deletus / Grouv [Grovelle]" (light brown, handwritten) // "TYPE" (red, printed) // "Muséum Paris / 1915 / coll. A. Grouvelle" (white, printed) // "SYNTYPE" (red, printed) // "SYNTYPE / Laemophloeus / deletus Grouvelle, 1896" (white, printed) // "MNHN, Paris / EC51920" (white, printed with QR code).

Distribution. BRAZIL. Bahia: Condeúba (formerly known as Santo Antônio da Barra).

Remarks. *Charaphloeus deletus* is similar to *C. aeneus* in overall body shape and colouration. However, they can be distinguished from each other by the first and second elytral cells absent in *C. deletus* (well-defined in *C. aeneus*) and by the antennomeres subglobose in *C. deletus* (more elongate in *C. aeneus*), the latter of which may reflect a secondary sexual difference, as the sex of the lectotypes could not be conclusively determined. Therefore, the validity of both as distinct species should be re-assessed through a comprehensive revision of the genus.

The size variation in the original description of this species indicates that more than one specimen composes the type series. However, only one original specimen was found and is here designated as the lectotype of this species (Fig. 1D). There is an additional, unlabelled specimen whose type status is unverified.

Charaphloeus gounellei (Grouvelle, 1896), comb. nov.

Fig. 2A–C

Laemophloeus gounellei Grouvelle, 1896: 190 (original combination); Kessel 1926: 89 (checklist); 1923: 93 (incorrect subsequent spelling to *L. grouvellei*); Hetschko 1930: 31 (checklist); Blackwelder 1945: 419 (checklist).

Type material. ***Lectotype*** • male (here designated) deposited at MNHN, labelled: "S Antonio / Bresil" (light brown, handwritten) // "Type" (light brown, handwritten) // "Laemophloeus / gounellei / Grouv" (light brown, handwritten) // "Muséum Paris / 1915 / coll. A. Grouvelle" (white, printed) // "SYNTYPE" (red, printed) // "SYNTYPE / Laemophloeus / gounellei Grouvelle, 1896" (white, printed) // "MNHN, Paris / EC51927" (white, printed with QR code). ***Paralectotype*** • at MNHN, labelled: "S Antonio / Bresil" (light brown, handwritten) // "Type" (light brown, handwritten) // "Muséum Paris / 1915 / coll. A. Grouvelle" (white, printed) // "SYNTYPE" (red, printed) // "SYNTYPE / Laemophloeus / gounellei Grouvelle, 1896" (white, printed) // "MNHN, Paris / EC51927" (white, printed with QR code).

Distribution. BRAZIL. Bahia: Condeúba (formerly known as Santo Antônio da Barra).

Remarks. This species is very similar to *C. deletus* comb. nov., with which it may be conspecific, as both were described from the same locality and exhibit no conspicuous morphological differences. However, a detailed morphological study including male genitalia is required to clarify the identity of both species. *Charaphloeus gounellei* comb. nov. also closely resembles *C. convexus* (Grouvelle, 1876) from Guatemala (see Bremer (2023: fig. 12)) in the general body shape and colouration, but *C. gounellei* comb. nov. has shorter mandibles and longer antennomeres than *C. convexus*.

The original description of *Laemophloeus gounellei* Grouvelle, 1896 lists "Cidade de Condeúba (Bahia)" as the type locality. Under the type specimens, the labels "S Antonio" (Fig. 2A) correspond to the historical name of Condeúba (Bahia, Brazil), which was formerly known as "Santo Antônio da Barra" prior to the proclamation of the Republic in 1889, the same period in which these specimens were likely collected by Pierre Emile Gounelle during his travel to the Brazilian state of Bahia (Condeúba) (Millot 1920). The two specimens are thus recognised as composing part of the type series, the male of which is here designated as the lectotype of this species (Fig. 2A–C).

Charaphloeus pilatei (Grouvelle, 1876), comb. nov.

Figs 2D–I, 3, 4

Laemophloeus pilatei Grouvelle, 1876: 496, plate 9: fig. 15 (original combination); Kessel 1923: 93 (checklist); 1926: 73, 91 (key, checklist); Hetschko 1930: 39 (checklist); Blackwelder 1945: 419 (checklist).

Type material. ***Lectotype*** • male (here designated) deposited at MNHN, labelled: "n. Fribo [Nova Friburgo]/ Deyr" (brown, handwritten) // "Type" (light brown, printed) // "Pilati / A. Grouv. Ann Fr. / p." (light brown, handwritten) // "Museum Paris / 1917 / coll. A. Grouvelle" (white, printed) // "SYNTYPE" (red, printed) // "SYNTYPE / Laemophloeus / pilatei Grouvelle, 1876" (white, printed) // "MNHN, Paris / EC51926" (white, printed with QR code).

Additional material. BRAZIL • Santa Catarina, Nova Teutônia, VIII.1967, Fritz Plaumann (leg.) (♀, DZUP, #325368); Brazil, Paraná, Ponta Grossa, 28.II.2000, Ganho and Marinoni (legs.) (♂, DZUP, 325614).

Diagnosis. Elytra maculate, each with a broad, longitudinally elongate lateral pale macula expanded medially towards the sutural stria. Male posterior tarsi pentamerous. Male endophallus with a medially coiled, long apical sclerite.

Re-description of male. (Figs 2D–I, 3A–D) Body length 2.4 mm, width at mid-elytra 0.9 mm; pronotal width 0.8 mm (widest point), medial length 0.5 mm; elytral width 0.4 mm (mid-elytron), length 1.3 mm. Body elongate, subparallel sided. ***Colouration.*** Head, pronotum, mouthparts and antennae light to dark brown, with mandibular apices and apical antennomeres darker; elytral ground colour light to dark brown, with large longitudinal, somewhat P-shaped pale macula expanded medially towards the sutural stria; venter light to dark brown. ***Head*** (Fig. 3A) large, 1.6 times wider than long, shorter and slightly narrower than pronotum; surface moderately punctate, with punctures as large as eye facets, each bearing a minute seta. Frontoclypeal suture well defined laterally, medially effaced. Frons broad,

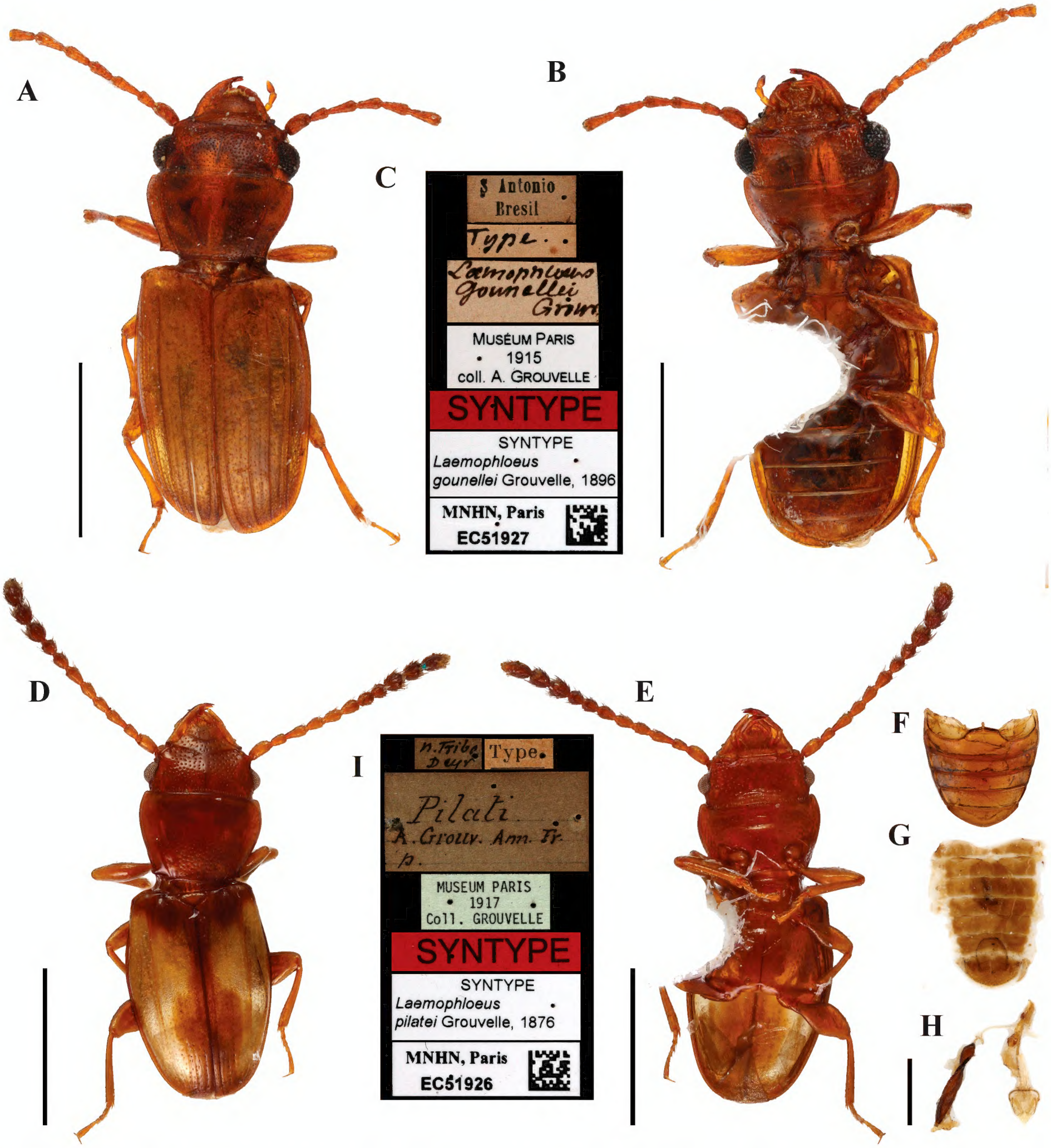

Figure 2. *Charaphloeus gounellei* (Grouvelle, 1896), comb. nov.: **A.** Dorsal view; **B.** Ventral view; **C.** Labels of the lectotype (here designated). *Charaphloeus pilatei* (Grouvelle, 1876), comb. nov.: **D.** Dorsal view; **E.** Ventral view; **F.** Abdominal ventrites; **G.** Abdominal tergites; **H.** Genitalia; **I.** Labels of the lectotype (here designated). Scale bars: 1 mm (**A, B, D, E, F–H**). Photographs by Christophe Rivier (MNHN).

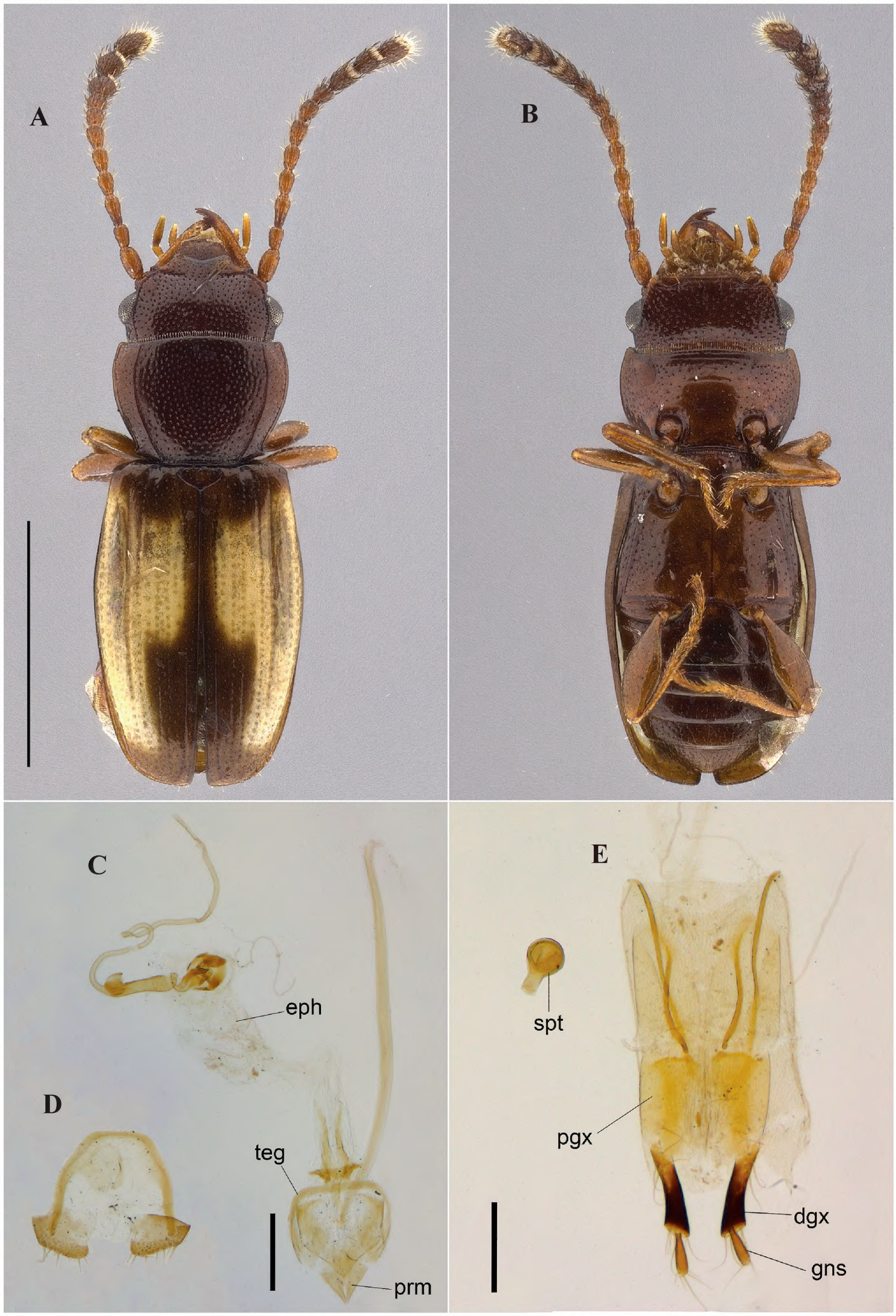

Figure 3. *Charaphloeus pilatei* (Grouvelle, 1876), comb. nov.: **A.** Dorsal view; **B.** Ventral view; **C.** Male genitalia; **D.** Claspers; **E.** Female spermatheca and external genitalia. Scale bars: 1 mm (**A, B, C, E**). Abbreviations: dgx = distal gonocoxite; eph = endophallus; gns = gonostylus; pgx = proximal gonocoxite; prm = parameres; spt = spermatheca; teg = tegmen.

with interocular width 8.3 times wider than transverse eye diameter. Median longitudinal line absent. Sublateral lines carinate, slightly curved. Clypeus 3-emarginate, with mandibular emargination broad. Labrum (Fig. 4B) large, as wide as labral emargination of clypeus, with anterior margin parabolic; surface moderately setose, with setae as long as labrum length (Fig. 4B). Mandibles (Fig. 4C, D) robust, elongate, slightly smaller than head and distinctly exposed beyond labrum, with two large apical teeth; incisive margin with one obtuse subapical tooth and one small, rounded medial tooth at right mandible (large, acute at left mandible; Fig. 4C, D); prostheca membranous and densely pilose; molar area divided into two parts: a small, strongly sclerotised, toothed area; and a large, poorly-sclerotised and microdenticulate area bearing about 10 rows of minute rounded denticles. Maxilla (Fig. 4E) elongate, with stipes as long as cardo and nearly straight externally; lacinia slender, with apex curved inwards and bifid; galea wide and longer than lacinia, with apex densely covered with long, apically curved setae; palp 4-segmented, palpomere 2 longer than 3, palpomere 4 elongate, longer than palpomeres 1–3 combined. Labium (Fig. 4A) large, with prementum broadly rounded, moderately covered with hair-like setae varying in length and short, spine-like apical setae; mentum short, stripe-shaped, transverse; submentum large, with apical angles narrowly rounded; palp 3-segmented, with palpomere 2 elongate, 3.7 times longer than palpomere 1, palpomere 3 slightly longer than palpomeres 1 and 2 combined. Genal processes absent. Antennae long, almost longer than half the body length; scape short, oblong-elongate, about 2.7 times longer than wide and distinctly shorter than antennomeres 2–3 combined; pedicel elongate, about 0.6 times the length of scape; flagellum gradually widened towards apex, with antennomeres slightly elongate and narrowest at base; club 3-segmented comprised of antennomeres 9–11; antennomeres 4–6 subequal in length, elongate and slightly shorter than 3; antennomeres 7–8 subequal in length, subglobose; 9–11 (club antennomeres) globose, subequal in length, larger than preceding antennomeres. ***Pronotum*** (Fig. 3A) subtrapezoidal, 1.4 times wider than long and 1.4 times wider anteriorly than posteriorly. Surface moderately punctate, not microreticulate; punctures similar in size to cephalic punctures. Lateral margins beaded, evenly

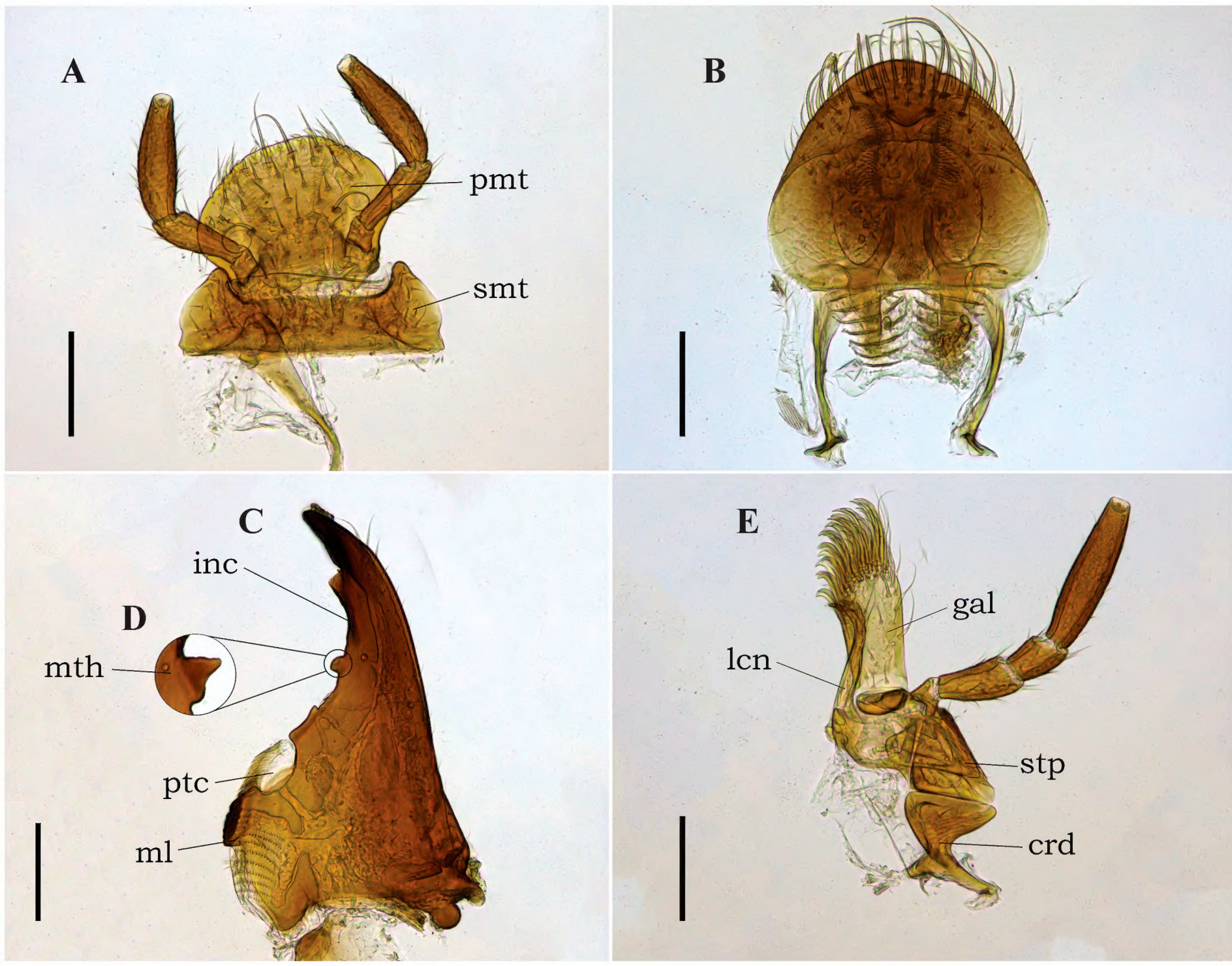

Figure 4. *Charaphloeus pilatei* (Grouvelle, 1876), comb. nov.: **A.** Labium; **B.** Labrum; **C.** Right mandible; **D.** Detail showing the incisive medial tooth of the left mandible; **E.** Right maxilla. Scale bars: 0.1 mm (**A, B, C, E**). Abbreviations: crd = cardo; stp = stipes; gal = galea; inc = incisivus; lcn = lacinia; ml = molar; mth = medial tooth; pmt = prementum; ptc = prostheca; smt = submentum.

curved anteriorly, constricted posteriorly. Anterior angles not produced, narrowly rounded; posterior angles acute, posterolaterally produced. Sublateral lines complete to anterior margin, carinate and deeply impressed. Anterior margin not beaded, with a row of bifid setae. ***Elytra*** (Fig. 3A) maculate, 1.5 times longer than conjunctly wide. Inner stria of cell 1 (sutural stria) medially effaced; striae of cells 2–3 poorly defined to indistinct. Epipleuron gradually narrowed and incomplete to apex. ***Legs*** (Fig. 3B) elongate, with tibiae slightly shorter than femurs. Femurs slender; metafemur larger than pro- and mesofemur, with medial width less than half the length. Pro-, meso- and metatarsus as long as respective tibiae, with inner surface moderately setose. Tarsal formula 5-5-5. ***Terminalia.*** Claspers with two transverse, rhomboidal lobes, with inner apical angles broadly rounded; apical margin with long setae (Fig. 3D). ***Aedeagus*** (Fig. 3C). Median lobe as wide as tegmen, with apex abruptly narrowed and acute. Parameres narrowly triangular, fused together at basal half, free at apical half, with apex acute. Endophallus with a barely sclerotised basal sclerite and a medially coiled, long apical sclerite.

Female. The female is very similar to the males and does not differ from them substantially. The internal and external genitalia are described as follows: Spermatheca globose, with a thumb-like projection; proximal gonocoxites longer than wide, weakly sclerotised; distal gonocoxites elongate, cylindrical, strongly sclerotised, as long as proximal gonocoxites, with long basal and apical setae; gonostyli club-shaped, as long as 1/3 of distal gonocoxites (Fig. 3E).

Distribution. BRAZIL. Rio de Janeiro: Nova Friburgo (Grouvelle 1876); Paraná: Ponta Grossa (new state record); Santa Catarina: Nova Teutônia (new state record).

Remarks. This is the only described species of *Charaphloeus* with elytral maculation, while all the other known species in the genus have unicoloured elytral surface (Bremer 2024). According to Thomas (1984), male tarsal formula is 5-5-4 in all the genera belonging to the '*Laemophloeus* genus group' (an informal group including *Charaphloeus* Casey, 1916, *Laemophloeus* (sens. str.) Dejean, 1835, *Homalirhinus* Chevrolat, 1833, *Metaxyphloeus* Thomas, 1984, *Phloeipsius* Casey and *Rhinophloeus* Sharp), except *Charaphloeus*, in which "both pentamerous and heteromerous male tarsi occur" (Thomas 1984). Males of *C. pilatei* also have pentamerous hind tarsi, although Bremer (2024) observed this is not a commonly found condition for the South American species, with only *C. lenzbeckeri* Bremer, 2024 males having 5-5-5 tarsal formula.

As no explicit evidence exists that Grouvelle (1876) based his description on a single specimen, the only labelled original specimen (Fig. 2E) is accepted as part of the type series and is here designated as the lectotype of this species in order to ensure nomenclatural stability. Two additional specimens from Paraná and Santa Catarina represent new state records of *C. pilatei*.

Authors contribution

MB: Writing – preparation of original draft, data curation, formal analysis, methodology; LZ: visualisation, writing – review and editing; JAR: Writing – review and editing.

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